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PATENT APPLICATION

ATTORNEY DOCKET NO. 200316547-1

IN THE  
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Randy L. Hoffman, et al.

Confirmation No.: 1458

Application No.: 10/799,961

Examiner: William F. Kraig

Filing Date: March 12, 2004

Group Art Unit: 2815

Title: SEMICONDUCTOR DEVICE

Mail Stop Appeal Brief-Patents  
Commissioner For Patents  
PO Box 1450  
Alexandria, VA 22313-1450

Amended  
TRANSMITTAL OF APPEAL BRIEF

Amended  
Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on June 12, 2006 and  
in response to the Notification of Non-Compliant Appeal Brief mailed  
The fee for filing this Appeal Brief is (37 CFR 1.17(c)) \$500.00 August 17, 2006  
(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

<input type="checkbox"/> 1st Month \$120	<input type="checkbox"/> 2nd Month \$450	<input type="checkbox"/> 3rd Month \$1020	<input type="checkbox"/> 4th Month \$1590
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☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

~~Please charge to Deposit Account 08-2025 the sum of \$ 500.~~ At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Signature: Sarah L. Reinhard

Respectfully submitted,

Randy L. Hoffman, et al.

By: Edward J. Brooks III

Edward J. Brooks III

Attorney/Agent for Applicant(s)

Reg No. : 40,925

Date : September 7, 2006

Telephone : (612) 236-0120



Docket No.: 200316547-1

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No. : 10/799,961  
Appellants: : Randy L. Hoffman, et al.  
Filed: : March 12, 2004  
TC/A.U. : 2815  
Examiner: : William F. Kraig  
Title: : Semiconductor Device

**AMENDED APPEAL BRIEF**

MS APPEAL BRIEF-PATENTS  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir or Madame:

This brief is presented under 37 CFR § 41.37 in support of an appeal from a Final Office Action of April 18, 2006 regarding the above-identified application. Notice of the Appeal was filed under 37 CFR § 41.31 on June 12, 2006. This brief is accompanied by the fee set forth in 37 CFR § 41.20(b)(2), as described in the accompanying TRANSMITTAL OF APPEAL BRIEF.

## **I. REAL PARTY IN INTEREST**

The real parties in interest for this appeal are:

A. The Hewlett Packard Development Company, LP, a limited partnership established under the laws of the State of Texas having a principal place of business in Houston, TX, the assignee of the application, and a subsidiary of the Hewlett Packard Company; and

B. The Hewlett Packard Company, a corporation established under the laws of the State of Delaware and having a principle place of in Palo Alto, California.

## **II. RELATED APPEALS AND INTERFERANCES**

The related application number 10/799,838 is presently under appeal. The application was filed on March 12, 2004, with the title "Semiconductor Device". The first listed inventor is Randy L. Hoffman. The Primary Examiner is William F. Kraig of Art Unit 2815.

The related application number 10/799,325 is also presently under appeal. The application was filed on March 12, 2004, with the title "Semiconductor Device". The first listed inventor is Randy L. Hoffman. The Primary Examiner is Thien F. Tran of Art Unit 2811.

## **III. STATUS OF CLAIMS**

A. Total Claims: 1-57

B. Current Status of Claims:

1. Claims canceled: none

2. Claims withdrawn: 21-36, and 45-47

3. Claims pending: 1-20, 37-44, and 48-57
4. Claims allowed: none
5. Claims rejected: 1-20, 37-44, and 48-57
6. Claims objected to: none

C. Claims on Appeal: 1-20, 37-44, and 48-57

#### **IV. STATUS OF AMENDMENTS**

Appellant has not filed any amendment to the application subsequent to the Final Office Action.

#### **V. SUMMARY OF CLAIMED SUBJECT MATTER**

##### **A. Independent claim 1**

Independent claim 1 recites a semiconductor device including a drain electrode, a source electrode, a channel contacting the drain electrode and the source electrode, and a gate dielectric positioned between a gate electrode and the channel. (Page 3, line 1, through page 4, line 24; page 10, line 34, through page 11, line 7; page 12, lines 22-33; page 14, lines 11-13; page 21, lines 28-30; and Figures 1A-1F, 2, and 3). With regard to the channel, the channel includes one or more compounds of the formula  $A_xB_xO_x$ , where each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and each of A and B are different. (Page 1, line 30, through page 2, line 6; page 6, lines 1-31; page 7, line 19, through page 8, line 4; page 11, lines 9-21; and page 15, lines 5-21).

Independent claim 1 is argued together with dependent claims 2, and 4-17.

1. Claim 6 is a dependent claim from independent claim 1 and

recites that the one or more compounds of the formula  $A_xB_xO_x$  includes  $C_x$ , to form a compound of the formula  $A_xB_xC_xO_x$ , where each C is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, and C are different. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 8, lines 6-30; and page 11, lines 9-21).

2. Claim 8 is a dependent claim from independent claim 1 and recites that the one or more compounds of the formula  $A_xB_xC_xO_x$  includes one or more of gallium-germanium-tin oxide, gallium-tin-lead oxide, gallium-germanium-lead oxide, gallium-indium-germanium oxide, gallium-indium-tin oxide, gallium-indium-lead oxide, indium-germanium-tin oxide, indium-tin-lead oxide, indium-germanium-lead oxide. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 8, lines 6-30; and page 11, lines 9-21).

3. Claim 10 is a dependent claim from dependent claim 6 and recites that the one or more compounds of formula  $A_xB_xC_xO_x$  includes  $D_x$ , to form a compound of the formula  $A_xB_xC_xD_xO_x$ , where each D is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, and D are different. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 8, 32, through page 9, line 17; and page 11, lines 9-21).

4. Claim 12 is a dependent claim from independent claim 1 and recites that the one or more compounds of the formula  $A_xB_xC_xD_xO_x$  includes one or more of gallium-germanium-tin-lead oxide, gallium-indium-germanium-tin oxide,

gallium-indium-germanium-lead oxide, gallium-indium-tin-lead oxide, indium-germanium-tin-lead oxide. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 11, lines 9-21; and page 8, 32, through page 9, line 17).

5. Claim 14 is a dependent claim from dependent claim 10 and recites that the one or more compounds of formula  $A_xB_xC_xD_xO_x$  includes  $E_x$ , to form a compound of the formula  $A_xB_xC_xD_xE_xO_x$ , where each E is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, D, and E are different. (Page 1, line 30, through page 2, line 6; page 11, lines 9-21; and page 9, line 19, through page 10, line 2).

6. Claim 16 is a dependent claim from independent claim 1 and recites that the one or more compounds of the formula  $A_xB_xC_xD_xE_xO_x$  includes one or more of gallium-indium-germanium-tin-lead oxide. (Page 1, line 30, through page 2, line 6; page 11, lines 9-21; and page 9, line 19, through page 10, line 2).

B. Independent claim 18

Independent claim 18 recites a semiconductor device including a drain electrode, a source electrode, a means for controlling current flow electrically coupled to the drain electrode and the source electrode, and a gate electrode separated from the channel by a gate dielectric. (Page 3, line 1, through page 4, line 24; page 10, line 34, through page 11, line 7; page 12, lines 22-33; page 14, lines 11-13; page 21, lines 28-30; and Figures 1A-1F, 2, and 3). With regard to the means for controlling current flow, the means includes one or more compounds of

the formula  $A_xB_xO_x$ , where each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, and each of A and B are different. (Page 1, line 30, through page 2, line 6; page 6, lines 1-31; page 7, line 19, through page 8, line 4; page 11, lines 9-21; and page 15, lines 5-21).

Independent claim 18 is argued together with dependent claim 20.

C. Independent claim 37

Independent claim 37 recites a semiconductor device formed by steps that include providing a drain electrode, providing a source electrode, providing a precursor composition, depositing a channel including the precursor composition to form a multicomponent oxide from the precursor composition to electrically couple the drain electrode to the source electrode, providing a gate electrode, and providing a gate dielectric positioned between the gate electrode and the channel. (Page 3, line 1, through page 4, line 24; page 10, line 34, through page 11, line 7; page 12, lines 22-33; page 14, lines 11-13; page 21, lines 28-30; and Figures 1A-1F, 2, and 3). With regard to the precursor composition, the precursor composition includes one or more precursor compounds that include  $A_x$  and one or more compounds that include  $B_x$ , where each A is selected from the group of Ga, In, each B is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and where each of A and B are different. (Page 1, line 30, through page 2, line 6; page 6, lines 1-31; page 7, line 19, through page 8, line 4; page 11, lines 9-21; page 14, line 15, through page 16, line 3; page 15, lines 5-21; and page 19, lines 6-22).

Independent claim 37 is argued together with dependent claims 38-44.

1. Claim 38 is a dependent claim from independent claim 37 and recites that the one or more precursor compounds includes one or more precursor compounds that include  $C_x$ , where each C is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, and C are different. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 8, lines 6-30; page 11, lines 9-21; page 15, lines 23-33; and page 19, lines 6-22).

2. Claim 39 is a dependent claim from dependent claim 38 and recites that the one or more precursor compounds includes one or more precursor compounds that include  $D_x$ , where each D is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, C, and D are different. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 11, lines 9-21; page 16, lines 1-9; page 18, lines 30-33; and page 19, lines 6-22).

3. Claim 40 is a dependent claim from dependent claim 39 and recites that the one or more precursor compounds includes one or more precursor compounds that include  $E_x$ , where each E is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, C, D, and E are different. (Page 1, line 30, through page 2, line 6; page 11, lines 9-21; page 16, lines 11-20; and page 19, lines 6-22).

D. Independent claim 48

Independent claim 48 recites a display device including a plurality of pixel devices configured to operate collectively to display images, where each of the pixel



devices includes a semiconductor device configured to control light emitted by the pixel device. (Page 10, lines 18-25; page 12, lines 14-20; page 21, line 32, through page 22, line 6; and Figure 4). The semiconductor device includes a drain electrode, a source electrode, a channel contacting the drain electrode and the source electrode, a gate electrode, and a gate dielectric positioned between the gate electrode and the channel and configured to permit application of an electric field to the channel. (Page 3, line 1, through page 4, line 24; page 10, line 34, through page 11, line 7; page 12, lines 22-33; page 14, lines 11-13; page 21, lines 28-30; and Figures 1A-1F, 2, and 3). With regard to the channel, the channel includes one or more compounds of the formula  $A_xB_xO_x$ , where each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A and B are different. (Page 1, line 30, through page 2, line 6; page 6, lines 1-31; page 7, line 19, through page 8, line 4; page 11, lines 9-21; and page 15, lines 5-21).

Independent claim 48 is argued together with dependent claims 49-56.

1. Claim 51 is a dependent claim from independent claim 48 and recites that the one or more compounds of the formula  $A_xB_xO_x$  includes  $C_x$ , to form a compound of the formula  $A_xB_xC_xO_x$ , where each C is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, and C are different. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 8, lines 6-30; and page 11, lines 9-21).

2. Claim 53 is a dependent claim from dependent claim 51 and recites that the one or more compounds of formula  $A_xB_xC_xO_x$ , includes  $D_x$ , to form a compound of the formula  $A_xB_xC_xD_xO_x$ , where each D is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, and D are different. (Page 1, line 30, through page 2, line 6; page 6, line 33, through page 7, line 17; page 8, 32, through page 9, line 17; and page 11, lines 9-21).

3. Claim 55 is a dependent claim from dependent claim 53 and recites that the one or more compounds of formula  $A_xB_xC_xD_xO_x$  includes  $E_x$ , to form a compound of the formula  $A_xB_xC_xD_xE_xO_x$ , where each E is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, D, and E are different. (Page 1, line 30, through page 2, line 6; page 11, lines 9-21; and page 9, line 19, through page 10, line 2).

E. Dependent claims 3, 19, and 57

1. Claim 3 is a dependent claim from independent claim 1 and recites that the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form. (Page 1, line 34, through page 2, line 1; page 10, lines 12-16 and lines 27-31; and page 19, line 22, through page 11, line 22).

2. Claim 19 is a dependent claim from independent claim 18 and recites that the means for a channel includes a means for forming one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline

form. (Page 1, line 34, through page 2, line 1; page 10, lines 12-16 and lines 27-31; and page 19, line 22, through page 11, line 22).

3. Claim 57 is a dependent claim from independent claim 48 and recites that the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form. (Page 1, line 34, through page 2, line 1; page 10, lines 12-16 and lines 27-31; and page 19, line 22, through page 11, line 22).

Claims 3, 19, and 57 are argued together.

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

A. Whether or not claims 1, 4, 6, 8, 10, 12, 14, 16, 18, 20, 48, 49, 51, 53, and 55 are unpatentable under 35 USC § 102(b) over Cillessen et al. (U.S. Patent 5,744,864) (“Semiconductor Device Having a Transparent Switching Element”).

B. Whether or not claims 2, 5, 7, 9, 11, 13, 15, 17, 37-44, 50, 52, 54, and 56 are unpatentable under 35 USC § 103(a) over Cillessen et al. (U.S. Patent 5,744,864) in view of Official Notice.

C. Whether or not claims 3, 19, and 57 are unpatentable under 35 USC § 103(a) over Cillessen et al. (U.S. Patent 5,744,864) in view of Sakashita et al. (U.S. Patent Application Publication 2004/0245561) (“Compositions for Thin-Film Capacitive Device, High-Dielectric Constant Insulating Film, Thin-Film Capacitance Device, and Thin-Film Multilayer Ceramic Capacitor”).

## **VII. ARGUMENT**

A. Arguments against the rejections under 102(b) over the Cillessen

reference.

1. Arguments regarding claims 1, 4, 6, 8, 10, 12, 14, 16, 18, 20, 48, 49, 51, 53, and 55.

a. **For claims 1, 4, 18, 20, 48, and 49, the cited reference does not disclose each and every claimed element.**

Appellant submits that the Cillessen reference appears to describe various embodiments of a “semiconductor device having a transparent switching element”. (Title). In contrast, Appellant believes that the claims 1, 4, 6, 8, 10, 12, 14, 16, 18, 20, 48, 49, 51, 53, and 55 are patentably distinct from the Cillessen reference for at least the following reasons.

Independent claims 1 and 48, as previously presented, recite in part:

a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more compounds of the formula  $A_xB_xO_x$ , wherein each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and each of A and B are different;

In section 3 of the April 18, 2006, Final Office Action, the Examiner cited the Cillessen reference as describing “the use of compounds of oxides including Ga, In, Ge, Sn and Pb, for the semiconductor material in a switching element”. (Citing Cillessen col. 2, lines 13-21). By stating, “Preferably, the basic material comprises a covalent oxide of a nontransition metal. Oxides of such metals and compounds of oxides of such metals, e.g. Ga, Bi, Sn, Zn, Sb, Pb, Ge, and In” (emphasis added), the cited section of the reference appears to describe eight binary oxides containing the stated elements. Cillessen discloses, for example, the following binary oxides:  $Ga_2O_3$ ;  $Bi_2O_3$ ;  $SnO_2$ ;  $ZnO$ ;  $Sb_2O_3$ ;  $PbO$ ;  $GeO_2$ ; and  $In_2O_3$ . (Col. 5, lines 40-41).

Considering “compounds of oxides of such metals”, Cillessen only discloses three ternary oxides, i.e.,  $\text{GaInO}_3$ ,  $\text{ZnGa}_2\text{O}_4$ , and  $\text{CdGa}_2\text{O}_4$ . (Col. 5, line 42). As such, Cillessen does not disclose any of the ternary compounds recited in independent claims 1 and 48, which each recite, “wherein each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, each O is atomic oxygen” (emphasis added).

The number of possible combinations in ternary oxides containing two of the elements disclosed by Cillessen not combined with itself is  $8 \times 7 = 56$ . By only disclosing three, the number of ternary oxides left unspecified by Cillessen (i.e., 53) leaves it up to the imagination of the inventor to formulate different ternary compounds. In the present application, Appellant has claimed six ternary oxides (see dependent claim 4) from the 53 that were undisclosed in the Cillessen reference.

In addition, independent claim 18, as previously presented, recites in part:

means for controlling current flow electrically coupled to the drain electrode and the source electrode, wherein the means for controlling current flow includes one or more compounds of the formula  $A_xB_xO_x$ , wherein each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, and each of A and B are different;

Because independent claim 18 recites particular elements presented above with regard to independent claims 1 and 48, the same arguments apply to independent claim 18.

**b. For claims 6, 8, 10, 12, 14, 16, 51, 53, and 55, the cited reference does not disclose each and every claimed element.**

With regard to dependent claims 6, 8, 10, 12, 14, 16, 51, 53, and 55, as

previously presented, the number of possible combinations in oxides containing one to eight of the eight elements disclosed by Cillessen not combined with itself is eight factorial (40,320). Claims 6 and 51 recite the formula  $A_xB_xC_xO_x$ , whereas claim 8 recites the possible formulations of such quaternary compounds; claims 10 and 53 recite the formula  $A_xB_xC_xD_xO_x$ , whereas claim 12 recites the possible formulations of such quinary compounds; and claims 14 and 55 recite the formula  $A_xB_xC_xD_xE_xO_x$ , whereas claim 16 recites the only possible formulation of such a sextanary compound. Using the two possible elements for A (Ga, In) and the three possible elements for B-E (Ge, Sn, Pb), where A, B, C, D, and E must be different elements,  $A_xB_xC_xO_x$  can be formulated in nine different combinations of the elements (see dependent claim 8),  $A_xB_xC_xD_xO_x$  can be formulated in five different combinations of the elements (see dependent claim 12), and  $A_xB_xC_xD_xE_xO_x$  can be formulated in only one combination of the elements (see dependent claim 16).

As a result, in addition to the six ternary oxides, Appellant is claiming a specific 21 combinations of quaternary, quinary, and sextanary oxides using five elements from the 40,320 possible combinations of eight elements (i.e., approximately 0.05% of the possible combinations) disclosed by Cillessen. Moreover, Cillessen does not disclose any specific quaternary, quinary, and sextanary oxides formulated from the disclosed eight elements.

As such, the Cillessen reference does not disclose each and every element of Appellant's independent claims 1, 18, and 48, as previously presented. Nor does Cillessen disclose each and every element of dependent claims 6, 8, 10, 12, 14, 16,

51, 53, and 55, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 102 rejection of independent claims 1, 18, and 48, as well as those claims that depend therefrom.

B. Arguments against the rejections under 103(a) over the Cillessen reference in view of Official Notice.

1. Arguments regarding claims 2, 5, 7, 9, 11, 13, 15, 17, 37-44, 50, 52, 54, and 56.

a. **For claims 37-44, the cited reference and Official Notice do not describe, teach, or suggest each and every claimed element.**

In addition to the reasons provided above, Appellant believes that the present disclosure as recited in claim 37 is patentably distinct from the Cillessen reference and the Official Notice for at least the following reasons.

Independent claim 37, as previously presented, recites in part:

providing a precursor composition including one or more precursor compounds that include A<sub>x</sub> and one or more compounds that include B<sub>x</sub>, wherein each A is selected from the group of Ga, In, each B is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A and B are different;

In section 4 of the April 18, 2006, Final Office Action, the Examiner stated that Cillessen “fails to disclose the step of providing a precursor composition.” However, citing *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985), the Examiner stated, “The particular process of providing a precursor is therefore irrelevant given that the final product of the claim is anticipated by Cillessen et al.”

As discussed above with regard to independent claims 1 and 48, Appellant

respectfully submits that the Cillessen reference does not disclose “wherein each A is selected from the group of Ga, In, each B is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A and B are different”, as recited in part in independent claims 1, 37, and 48, as previously presented. In addition, Appellant respectfully submits that the Official Notice does not cure the deficiencies of the Cillessen reference. As a result, the final product of independent claim 37 is not anticipated by Cillessen and the failure of Cillessen to disclose the step of providing a precursor composition becomes relevant as another element distinguishing the present disclosure, as recited in independent claim 37, from Cillessen.

With regard to dependent claims 38-40, as discussed above, no quaternary, quinary, and sextanary oxides are disclosed by Cillessen. Hence, additionally including one or more precursor compounds that include  $C_x$  in claim 38, that include  $D_x$  in claim 39, and that include  $E_x$  in claim 40 to the  $A_x$  and  $B_x$  recited in independent claim 37 become further elements distinguishing the present disclosure from Cillessen.

As such, the Cillessen reference and the Official Notice, either independently or in combination, do not describe, teach, or suggest each and every element in Appellant’s independent claim 37, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103 rejection of independent claim 37, as previously presented, as well as of claims 38-44, which depend therefrom.

Moreover, section I of MPEP 2144.08 is entitled, “Guidelines for the



Examination Of Claims Directed To Species Of Chemical Compositions Based Upon A Single Prior Art Reference”. The first section states in part, “Office personnel should follow these guidelines to determine whether a single reference 35 U.S.C. 103 rejection would be appropriate.” The first section goes on to state, “When evaluating the scope of a claim, every limitation in the claim must be considered. [Citation omitted]. However the claimed invention may not be dissected into discrete elements to be analyzed in isolation, but must be considered as a whole.”

Section II of MPEP 2144.08 is entitled, “Determine Whether The Claimed Species Or Subgenus Would Have Been Obvious To One of Ordinary Skill In The Pertinent Art At The Time The Invention Was Made”. The second section states in part, “The fact that a claimed species or subgenus is encompassed by a prior art genus is not sufficient to establish a *prima facie* case of obviousness.” The second section goes on to state, “Federal Circuit has “decline[d] to extract from *Merck* [citation omitted] the rule that ... regardless of how broad, a disclosure of a chemical genus renders obvious any species that happens to fall within it.”

Subsection 4 of section II of MPEP 2144.08 states in part, ““([A] *prima facie* case of unpatentability requires that the teachings of the prior art suggest *the claimed compounds* to a person of ordinary skill in the art.” (emphasis in original)).” Subsection 4 goes on the state, “The prior art must provide one of ordinary skill in the art the motivation to make the proposed molecular modifications needed to arrive at the claimed compound.” Relevant to the preceding statement is the section of MPEP 2143.01 entitled, “Fact That The Claimed Invention Is Within The

Capabilities Of One Of Ordinary Skill In The Art Is Not Sufficient By Itself To Establish *Prima Facie* Obviousness”. The section states in part (emphasis added):

A statement that modifications of the prior art to meet the claimed invention would have been “ ‘well within the ordinary skill of the art at the time the claimed invention was made’ ” because the references relied upon teach that all the aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.

The just-cited MPEP section goes on to state that “The level of skill in the art cannot be relied upon to provide the suggestion to combine references.”

b. **For claims 2, 5, 7, 9, 11, 13, 15, 17, 50, 52, 54, and 56, the cited reference and Official Notice do not describe, teach, or suggest each and every claimed element.**

Claims 2, 5, 7, 9, 11, 13, 15, 17, 50, 52, 54, and 56 are dependent claims from independent claims 1 and 48. With regard to dependent claims 2, 5, and 50, Appellant submits that the broad characterization of possible combinations of the eight stated elements in Cillessen, along with the narrow range of ternary examples provided therein, does not render obvious to one of ordinary skill in the art the six combinations of elements in ternary oxides made possible by independent claims 1 and 48, as previously presented.

With regard to dependent claims 7, 9, 11, 13, 15, 17, 52, 54, and 56, Appellant submits that Cillessen does not, by stating a list of eight elements, although specifying no compounds for the channel that contain more than two from the list in combination with oxygen, make obvious to one of ordinary skill in the art the specific oxide compounds containing three, four, or five different listed elements

that are made possible by dependent claims of the present application.

Appellant respectfully submits that the Official Notice does not cure the deficiencies of the Cillessen reference with regard to dependent claims 7, 9, 11, 13, 15, 17, 52, 54, and 56, nor does the Official Notice cure the deficiencies of the Cillessen reference with regard to independent claims 1 and 48, as well as claims 2, 5, and 50 that depend therefrom.

As such, the Cillessen reference and the Official Notice, either independently or in combination, do not describe, teach, or suggest each and every element in Appellant's independent claims 1 and 48, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103 rejection of dependent claims 2, 5, 7, 9, 11, 13, 15, 17, 50, 52, 54, and 56, which are dependent claims from independent claims 1 and 48.

C. Arguments against the rejections under 103(a) over the Cillessen reference in view of Sakashita et al.

1. Arguments regarding claims 3, 19, and 57.

a. **For claims 3, 19, and 57, the cited references do not describe, teach, or suggest each and every claimed element.**

Appellant respectfully submits that the Sakashita reference does not constitute prior art with regard to the present disclosure. Section II of MPEP 1896, entitled Effective Date As A Reference, states a number of conditions that must be met for a reference resulting from an international application to qualify as prior art relative to a patent application filed with the USPTO. The third condition stated therein is that if the international application is "published under PCT Article 21(2)

in English, the international filing date is a U.S. filing date for prior art purposes under 35 U.S.C. 102(e).” (Emphasis added).

Appellant notes that the Sakashita U.S. Patent Application Publication published on December 9, 2004, provides Foreign Application Priority Data stating that relevant Japanese patents had filing dates of August 28, 2001, and March 1, 2002. Appellant determined that an international WIPO application (WO 2003021615) claiming priority to the particular Japanese patents was published March 13, 2003, and that the international application resulted from a PCT filed on August 26, 2002. Appellant further notes that the international application appears to be published in Japanese and not in English except for the Abstract. Apparently, no patent based thereon has yet issued.

The English abstract of the PCT application does not teach, “wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form”, as recited in dependent claims 3 and 57, as originally presented. Nor does the English abstract teach, “wherein the means for controlling current flow includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form”, as recited in dependent claim 19, as originally presented. Notably, the English abstract does not disclose any information about a channel or means for controlling current flow having a particular form (e.g., amorphous, single-phase crystalline, or mixed-phase crystalline).

As such, in accordance with MPEP 1896, the Sakashita international PCT application does not qualify under 35 U.S.C. 102(e) as prior art relative to the present application because it was not published in English to enable an effective

date as a reference. Of further note, because it was published on March 13, 2003, the Sakashita PCT application was published less than a year prior to the March 12, 2004, filing date of the present application and would not qualify as prior art under 35 U.S.C. 102(b). In addition, the Sakashita reference appears to have been first published in English on December 9, 2004, as the U.S. Patent Application Publication US 2004/0245561, which was after the March 12, 2004, filing date of the present application.

In the alternative, even if Sakashita is determined to be a reference suitable for consideration, Appellant submits that the reference is insufficient to support a *prima facie* § 103(a) obviousness rejection in combination with the Cillessen reference. In particular, Appellant submits that the Sakashita reference appears to describe, “A thin-film capacitor (2) in which a lower electrode (6), a dielectric thin-film (8), and an upper electrode (10) are formed in order on a substrate (4).” (Abstract). In contrast, Appellant believes that claims 3, 19, and 57 are patentably distinct from the Cillessen reference and the Sakashita reference for at least the following reasons.

Claims 3 and 57, as originally presented, are dependent claims from independent claims 1 and 48, respectively. Each of claims 3 and 57 recites, “wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.”

With regard to dependent claim 3, the Examiner stated, in section 4 of the April 18, 2006, Final Office Action, that Cillessen “fails to specifically disclose that the metal oxide is formed in one of an amorphous form, a single-phase crystalline

form, and a mixed-phase crystalline form.” However, the Examiner went on to state that Sakashita “discloses the formation (using Pulsed Laser Deposition (Paragraph 48, Lines 12-18)) of a thin film of Indium Tin Oxide 6 in an amorphous form (Paragraph 49, Lines 1-3).”

Firstly, Sakashita shows no channel and the “thin film of Indium Tin Oxide 6” being referred to is the “lower electrode (6)”, described in the Abstract quoted above, which appears to be equivalent to the “drain electrode” or the “source electrode” recited in independent claims 1, 18, and 48. Secondly, by stating in paragraph 0049, lines 1-3, “Lower electrode thin-film 6 using amorphous materials for substrate 4 can be composed of conducting glass such as ITO”, the reference appears to describe a lower electrode thin-film that can be composed of a transparent conductor, such as ITO (e.g.,  $\text{In}_x\text{Sn}_x\text{O}_x$ ), on a substrate using amorphous materials such as glass. The lower electrode thin-film 6 is not a channel that can use amorphous materials.

Lastly, substrate 4 is described as being “composed of single crystal with high matched lattice (ex. single crystal  $\text{SrTiO}_3$ ,  $\text{MgO}$  or  $\text{LaAlO}_3$ ), amorphous materials (ex. glass, fused quartz or  $\text{SiO}_2/\text{Si}$ ) and other materials (ex.  $\text{ZrO}_2/\text{Si}$  or  $\text{CeO}_2/\text{Si}$ ) or so.” (Paragraph 0047, lines 1-4, emphasis added). Hence, the Sakashita reference does not show “wherein the channel includes one of an amorphous form”, as recited in dependent claims 3 and 57, as originally presented, because the reference does not describe a channel, only a substrate or a lower electrode are described as possibly being composed of amorphous materials, and the stated choices for amorphous materials (i.e., glass, fused quartz or  $\text{SiO}_2/\text{Si}$ ) do not

include the ternary oxide compound possibilities recited in Appellant's independent claims 1 and 48, as previously presented.

Claim 19, as previously presented, is a dependent claim from independent claim 18 and recites, "wherein the means for controlling current flow includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form."

As such, the Cillessen reference and the Sakashita reference, either independently or in combination, do not describe, teach, or suggest each and every element in Appellant's dependent claims 3, 19, and 57, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103 rejection of dependent claims 3, 19, and 57, as previously presented, which are dependent claims from independent claims 1, 18, and 48.

Moreover, the Examiner stated in the first Office Action that "it is well known in the art to form metal oxides in amorphous form". Appellant respectfully submits that a "channel", as recited in dependent claims 3 and 57, or a "means for controlling current flow", as recited in dependent claim 19, comprising metal oxides is difficult to prepare in an amorphous form and, therefore, is not commonly done, regardless of whether the metal oxide is as simple as ZnO, as disclosed by Cillessen, or as complex as  $A_xB_xC_xD_xE_xO_x$ , as recited in the present application. As such, Appellant respectfully submits that utilizing one or more compounds of the formula  $A_xB_xC_xO_x$  in amorphous form is "not capable of instant and unquestionable demonstration as being well-known", as required by MPEP section 2144.03 when an Examiner takes Official Notice without being "supported by citation to some

reference work recognized as a standard in the pertinent art.” If rejection of dependent claims 3, 19, and 57 pursuant to Official Notice is sustained, Appellant respectfully requests citation to “some reference work recognized as a standard in the pertinent art”, the pertinent art being formation of channels from metal oxides in semiconductor devices.



### CONCLUSION

Appellant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner and/or members of the Board are invited to telephone Appellant's attorney Donald J. Coulman at (541) 715-1694 to facilitate this appeal.

At any time during the pendency of this application, please charge any additional fees or credit overpayment to the Deposit Account No. 08-2025.

**CERTIFICATE UNDER 37 C.F.R. §1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: **MS APPEAL BRIEF-PATENTS** Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on this 7<sup>th</sup> day of September, 2006.

Sarah L. Reinhard  
Name

Sarah L. Reinhard  
Signature

Respectfully Submitted,  
Randy L. Hoffman, et al.

By their Representatives:  
BROOKS & CAMERON, PLLC  
1221 Nicollet Avenue, Suite 500  
Minneapolis, MN 55403

Edward J. Brooks III  
Atty: Edward J. Brooks III  
Reg. No.: 40,925

Date: 9/7/2006

## VIII. CLAIMS APPENDIX

1. (Previously Presented) A semiconductor device, comprising:
  - a drain electrode;
  - a source electrode;
  - a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more compounds of the formula  $A_xB_xO_x$ , wherein each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and each of A and B are different; and
  - a gate dielectric positioned between a gate electrode and the channel.
2. (Original) The semiconductor device of claim 1, wherein the one or more compounds of the formula  $A_xB_xO_x$  includes a ratio of A:B, wherein A, and B, are each in a range of about 0.05 to about 0.95.
3. (Original) The semiconductor device of claim 1, wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.
4. (Previously Presented) The semiconductor device of claim 1, wherein the one or more compounds of the formula  $A_xB_xO_x$  includes one or more of gallium-germanium oxide, gallium-tin oxide, gallium-lead oxide, indium-germanium oxide, indium-tin oxide, indium-lead oxide.

5. (Previously Presented) The semiconductor device of claim 4, wherein the one or more compounds of the formula  $A_xB_xO_x$  includes an atomic composition of ratio A:B, wherein A, and B, are each in a range of about 0.05 to about 0.95.
6. (Previously Presented) The semiconductor device of claim 1, wherein the one or more compounds of the formula  $A_xB_xO_x$  includes  $C_x$ , to form a compound of the formula  $A_xB_xC_xO_x$ , wherein each C is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, and C are different.
7. (Original) A The semiconductor device of claim 6, wherein the one or more compounds of the formula  $A_xB_xC_xO_x$  includes a ratio of A:B:C, wherein A, B, and C, are each in a range of about 0.025 to about 0.95.
8. (Previously Presented) The semiconductor device of claim 1, wherein the one or more compounds of the formula  $A_xB_xC_xO_x$  includes one or more of gallium-germanium-tin oxide, gallium-tin-lead oxide, gallium-germanium-lead oxide, gallium-indium-germanium oxide, gallium-indium-tin oxide, gallium-indium-lead oxide, indium-germanium-tin oxide, indium-tin-lead oxide, indium-germanium-lead oxide.

9. (Previously Presented) The semiconductor device of claim 8, wherein the one or more compounds of the formula  $A_xB_xC_xO_x$  includes an atomic composition of ratio A:B:C, wherein A, B, and C, are each in a range of about 0.025 to about 0.95.
10. (Previously Presented) The semiconductor device of claim 6, wherein the one or more compounds of formula  $A_xB_xC_xO_x$  includes  $D_x$ , to form a compound of the formula  $A_xB_xC_xD_xO_x$ , wherein each D is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, and D are different.
11. (Original) The semiconductor device of claim 10, wherein the one or more compounds of the formula  $A_xB_xC_xD_xO_x$  includes a ratio of A:B:C:D, wherein A, B, C, and D, are each in a range of about 0.017 to about 0.95.
12. (Previously Presented) The semiconductor device of claim 1, wherein the one or more compounds of the formula  $A_xB_xC_xD_xO_x$  includes one or more of gallium-germanium-tin-lead oxide, gallium-indium-germanium-tin oxide, gallium-indium-germanium-lead oxide, gallium-indium-tin-lead oxide, indium-germanium-tin-lead oxide.
13. (Previously Presented) The semiconductor device of claim 12, wherein the one or more compounds of the formula  $A_xB_xC_xD_xO_x$  includes an atomic

composition of ratio A:B:C:D, wherein A, B, C, and D, are each in a range of about 0.017 to about 0.95.

14. (Previously Presented) The semiconductor device of claim 10, wherein the one or more compounds of formula  $A_xB_xC_xD_xO_x$  includes  $E_x$ , to form a compound of the formula  $A_xB_xC_xD_xE_xO_x$ , wherein each E is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

15. (Original) The semiconductor device of claim 14, wherein the one or more compounds of the formula  $A_xB_xC_xD_xE_xO_x$  includes a ratio of A:B:C:D:E, wherein A, B, C, D, and E, are each in a range of about 0.013 to about 0.95.

16. (Previously Presented) The semiconductor device of claim 1, wherein the one or more compounds of the formula  $A_xB_xC_xD_xE_xO_x$  includes one or more of gallium-indium-germanium-tin-lead oxide.

17. (Original) The semiconductor device of claim 16, wherein the gallium-indium-germanium-tin-lead oxide includes an atomic composition of ratio A:B:C:D:E, wherein A, B, C, D, and E, are each in a range of about 0.013 to about 0.95.

18. (Previously Presented) A semiconductor device, comprising:

a drain electrode;

a source electrode;

means for controlling current flow electrically coupled to the drain electrode and the source electrode, wherein the means for controlling current flow includes one or more compounds of the formula  $A_xB_xO_x$ , wherein each A is selected from the group of Ga, In, each B is selected from the group of Ge, Sn, Pb, and each of A and B are different; and

a gate electrode separated from the channel by a gate dielectric.

19. (Previously Presented) The semiconductor device of claim 18, wherein the means for controlling current flow includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

20. (Original) The semiconductor device of claim 18, wherein the source, drain, and gate electrodes include a substantially transparent material.

21-36. (Withdrawn)

37. (Previously Presented) A semiconductor device formed by the steps, comprising:

providing a drain electrode;

providing a source electrode;

providing a precursor composition including one or more precursor compounds that include  $A_x$  and one or more compounds that include  $B_x$ , wherein each A is selected from the group of Ga, In, each B is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A and B are different;

depositing a channel including the precursor composition to form a multicomponent oxide from the precursor composition to electrically couple the drain electrode and the source electrode;

providing a gate electrode; and

providing a gate dielectric positioned between the gate electrode and the channel.

38. (Previously Presented) The semiconductor device of claim 37, wherein the one or more precursor compounds includes one or more precursor compounds that include  $C_x$ , wherein each C is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, and C are different.

39. (Previously Presented) The semiconductor device of claim 38, wherein the one or more precursor compounds includes one or more precursor compounds that include  $D_x$ , wherein each D is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, C, and D are different.

40. (Previously Presented) The semiconductor device of claim 39, wherein the one or more precursor compounds includes one or more precursor compounds that include  $E_x$ , wherein each E is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

41. (Original) The semiconductor device of claim 40, wherein depositing the channel includes vaporizing the precursor composition to form a vaporized precursor composition, and depositing the vaporized precursor composition using a physical vapor deposition technique including one or more of dc reactive sputtering, rf sputtering, magnetron sputtering, ion beam sputtering.

42. (Original) The semiconductor device of claim 37, wherein providing the source, the drain, and the gate electrodes includes providing a substantially transparent form of the source, the drain, and the gate electrodes.

43. (Original) The semiconductor device of claim 37, wherein providing the precursor composition includes providing a liquid form of the precursor composition.

44. (Original) The semiconductor device of claim 43, wherein depositing the channel includes an ink-jet deposition technique when the precursor composition includes the liquid form.



45-47. (Withdrawn)

48. (Previously Presented) A display device, comprising:

a plurality of pixel devices configured to operate collectively to display images, where each of the pixel devices includes a semiconductor device configured to control light emitted by the pixel device, the semiconductor device including:

a drain electrode;

a source electrode;

a channel contacting the drain electrode and the source electrode,

wherein the channel includes one or more compounds of the formula

$A_xB_xO_x$ , wherein each A is selected from the group of Ga, In, each B is

selected from the group of Ge, Sn, Pb, each O is atomic oxygen, each x is

independently a non-zero number, and wherein each of A and B are

different;

a gate electrode; and

a gate dielectric positioned between the gate electrode and the channel and configured to permit application of an electric field to the channel.

49. (Original) The display of claim 48, wherein the source, the drain, and the gate electrodes include a substantially transparent material.

50. (Original) The display of claim 48, wherein the one or more compounds of the formula  $A_xB_xO_x$  includes an atomic composition of ratio A:B, wherein A, and B, are each in a range of about 0.05 to about 0.95.

51. (Previously Presented) The display of claim 48, wherein the one or more compounds of the formula  $A_xB_xO_x$  includes  $C_x$  to form a compound of the formula  $A_xB_xC_xO_x$ , wherein each C is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, and C are different.

52. (Original) The display of claim 51, wherein the one or more compounds of the formula  $A_xB_xC_xO_x$  includes an atomic composition of ratio A:B:C, wherein A, B, and C, are each in a range of about 0.025 to about 0.95.

53. (Previously Presented) The display of claim 51, wherein the one or more compounds of formula  $A_xB_xC_xO_x$  includes  $D_x$ , to form a compound of the formula  $A_xB_xC_xD_xO_x$ , wherein each D is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, and D are different.

54. (Original) The display of claim 53, wherein the one or more compounds of the formula  $A_xB_xC_xD_xO_x$  includes an atomic composition of ratio A:B:C:D, wherein A, B, C, and D, are each in a range of about 0.017 to about 0.95.

55. (Previously Presented) The display of claim 53, wherein the one or more compounds of formula  $A_xB_xC_xD_xO_x$  includes  $E_x$ , to form a compound of the formula  $A_xB_xC_xD_xE_xO_x$ , wherein each E is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

56. (Original) The display of claim 55, wherein the one or more compounds of the formula  $A_xB_xC_xD_xE_xO_x$  includes an atomic composition of ratio of A:B:C:D:E, wherein A, B, C, D, and E, are each in a range of about 0.013 to about 0.95.

57. (Original) The display of claim 48, wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

**IX. EVIDENCE APPENDIX**

None

## **X. RELATED PROCEEDINGS APPENDIX**

Appellant submits that no copies currently exist of decisions rendered by a court or the Board in any proceeding identified pursuant to paragraph (c)(1)(ii) of section 41.37 with regard to Application Number 10/799,838, Application Number 10/799,325, and Application Number 10/799/961.